Mapping Of Nutrient Status Of C-Organic And N-Total Soil In The Paddy Fields Of The Duchy District Majalengka Regency

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Abstract: This study aims to determine the mapping of soil C-organic nutrient status in rice fields in the Majalengka District. The experiment was conducted in the District of the Duchy of Majalengka Regency with an altitude of 855 m above sea level. Kadipaten District has an area of 2,157 ha, with land contours varying from flat to proven. This study starts from January to March 2023. The research method used in this study is mixed because it can answer the problem formulation descriptively, qualitatively, and statistically quantitatively. The method used to take soil samples is the free grid method with a detailed survey rate on a map scale of 1:50,000. The method used for interviews with farmers is the simple random sampling method. The results showed that the area of rice fields in the District of the Duchy, which occupies seven delineated villages, is an area of 1,361.76 ha. Where the area of rice fields in the District of the Duchy is irrigated rice fields covering an area of 917.39 ha and rainfed rice fields covering an area of 444.36 ha, with three criteria for the content of C-organic status, namely medium 598.48 ha (43.95%) occupies part of Pagandon Village, Karang Sambung, Babakan Anyar, and Kadipaten. The area with a low C-organic area is 512.38 ha (37.63%), occupying parts of Pagandon, Karang Sambung, Babakab Anyar, Liangjualang, Heuleut, and Cipaku villages. Then, for the very low C-organic criterion, 250.90 ha (18.42%) occupies part of the village area. Liangjulang, Heuleut and Cipaku.

Keywords: C-organic, N-Total, Mapping, Rice Field

INTRODUCTION

Organic matter is a part of the soil that comes from all types of organic compounds found in the soil. This compound comes from the remains of living things such as animal waste in the form of solid or liquid and plant litter that has undergone a decomposition process by microorganisms. The content of organic matter in the soil needs to be known, one of which is to find out, namely with geographic information systems and laboratory analysis. Currently land is a very valuable natural resource, in addition to the foothold and residence of living things, land is able to produce a material that can be consumed by all living things. Humans use land as a place of cultivation and business to produce food with the aim of meeting their needs. These efforts can be hampered if humans do not study the natural environment and the potential of the land to be used. Efforts to know soil potential effectively require knowledge of soil data and information and spatial distribution patterns in a landscape (Kemala et al., 2017).

Land surveying and mapping is a unitary system that is interrelated. Soil surveys are carried out in order to be able to identify soil in an area and then mapped into an information map about the distribution of soil nutrients. Nowadays geographic information systems are very important to provide geographic information about mapping soil c-organic nutrient status.

Rice fields are land used to grow rice both planted throughout the year and in turns with crops. Rice fields that come from irrigated irrigation are called irrigated rice fields while rice fields that come from rainwater irrigation are called rainfed rice fields. There are also rice fields in tidal areas called tidal rice fields, while rice fields developed in swampy areas are called lebak rice fields (Harahap et al., 2021).

RESEARCH METHODS

This research was carried out in the District of the Duchy of Majalengka Regency with an altitude of 855 m above sea level. Kadipaten District has an area of 2,157 ha with land contours varying from flat to proven. Soil sample testing was carried out at the UPTD Agro Chemistry Laboratory, Bangun Food Crop Protection and Horticulture Center. Meanwhile, the time for this research is from January to March 2023**.** The materials used in this study are village administrative boundary maps on a scale of 1:25,000 in 2022, soil type maps on a scale of 1:250,000, satellite images from 2019-2021 and soil samples taken from the research site. While the equipment used is the tools used in this study, namely soil drills to take soil samples, knives to assist in the process of soil sampling, buckets as containers to composite soil samples, plastic bags for soil samples from

the research location, labels and other stationery to provide the identity of soil samples that have been taken, sacks as containers to collect soil samples that have been labeled, mortar and pestles to smooth the soil, filters to filter the soil to be smooth, HP cameras to document activities, GPS (Global Positioning System) as a tool to determine coordinate points, laptops as a means of processing research data results, Avenza Map is a smartphone application to help field orientation, and ArcMap is one component of ArcGIS which is a Geographic Information System (GIS)-based software to process spatial data.
The research method used in this study is a mixed method because it can answer the problem formulation descriptively qualitatively and statistically quantitatively. The method used to take soil samples is the free grid method with a detailed survey rate on a map scale of 1:50,000. While the method used for interviews with farmers is the simple random sampling method. The determination of the sample location point was determined from the digitization results of rice fields based on a physiographic approach, so that 25 observation points were obtained (annex 3). The method for analyzing C-organic soil is using the Walkay and Black method carried out by experts UPTD Agro Chemistry Laboratory, Bandung Center for Food Crop Protection and Horticulture. The data generated based on field results and laboratory analysis results are then processed using ArcGis software and in conducting map analysis using the kriging method, which is a technique in spatial and statistical analysis used to estimate or predict values in locations that have not been measured based on measurement data around them.

RESULTS AND DISCUSSION

1. Overview of the Research Area

Kadipaten District is a sub-district located in Majalengka Regency, West Java Province. Geographically, Kadipaten District is located at an altitude of 51 m above sea level with coordinate boundaries of 108°07' - 108°12' East Longitude and 6°45' - 6°52' South Latitude with the following boundaries**:**

- The north side is bordered by Kertajati District
- The south side is bordered by Panyingkiran District
- The west is bordered by Sumedang Regency
- East border with Dawuan District

2. Land Processing

Based on data obtained from interviews with farmers, it is known that land management by applying organic matter into the soil, such as applying manure to the land, is 32% and returning the remaining straw to the land by 44%. As for the transportation of organic matter from the soil, such as taking straw from harvest residues for animal feed, compost, and mushrooms by 48% and burning straw by 80%.

Table 1. Management of organic matter by farmers

Land management	Number of Respondents	%
Applying manure to the field	8	32
Not applying manure to the field	17	68
Return crop residue to the field	11	44
Not returning the remaining straw to the field	14	56
Taking hay from crop residues for animal feed	12	48
Not taking hay from crop residues for animal feed	13	52
Burning straw	20	80
Do not burn hay	5	20

Based on Table 1, the results of interviews with farmers show that 80% of farmers burn straw and 48% take straw from crop residues, resulting in the loss of nutrients that can be returned to the soil in addition to causing air pollution when straw is burned.
The application of organic fertilizer from the interview results in Table 5 shows 32%, meaning that public awareness of the Duchy District is still low, with providing organic fertilizer as an important aspect of sustainable agricultural land management. Organic fertilizers have benefits in increasing soil fertility, improving soil structure, increasing the availability of nutrients for plants, and reducing the risk of environmental pollution. This is in line with the research of Yunus et al, (2019), the use of organic fertilizers can help increase crop yields and reduce farmers' dependence on fertilizers

3. Crop Rotation

Based on the data in Table 6, crop rotation can be used as one of the factors causing soil C-organic content in rice fields of Kadipaten District only has very low, low, and medium criteria. The C-organic content of the soil is very low to medium because of the planting pattern of 2x rice and 1x onions. Onions, watermelons, and

vegetables are types of plants that absorb a lot of nutrients in the soil. So the soil has no time to condition nutrients to remain stable but will gradually decrease to very low criteria if not given organic fertilizer as a counterbalance so that soil conditions remain fertile. Meanwhile, rice planting rotation with interspersed crops will be better soil conditions because there are several crops that are able to produce C-organic. This is in line with Christensen et al (2012) in Agus and Johannes (2019), proper crop rotation can increase soil organic matter, minimize soil degradation, improve soil structure and increase crop productivity so that profits in farming are greater and prolonged

Table 2. Crop Rotation of Rice Fields within One Year

Crop Rotation	Sum	Percentage
Rice 3x	5	20
Rice 2x, onion 1x	8	32
Rice 2x, Palawija 1x	4	16
Rice 2x, Watermelon 1x	3	12
Rice 1x, Palawija 1x, Fallow	5	20
Total	**25**	**100**

4. Planting Pattern

Planting pattern is an effort to engineer planting technology on a piece of land by arranging the layout and sequence pattern of plants during a certain period by taking into account natural conditions. This planting pattern is designed with the aim of optimizing the use of land, resources, and time so that crop yields can be increased.

Based on interviews with farmers, the implementation of the legowo row system was only 7 farmers or 28% (table 3). Most farmers have not implemented the legowo row system because farmers feel that the results obtained from the planting system they usually use, namely the tile planting system, are equivalent to the legowo row planting system. In fact, by implementing the Legowo row planting system, farmers are much easier to maintain and optimize rice growing space. This factor can be one of the causes of the nonattainment of the average rice productivity of the Duchy District at the Majalengka Regency level.

Table 3. Rice Planting System of Duchy District

Cropping System	Total Percentage (%)	Total Percentage (%)
Jajar Legowo	7	28
Floor Tiles	18	71
Total	**25**	**100**

1. C–Organic Soil

Based on the results of C-organic laboratory analysis and assessment criteria for soil chemical properties according to the Staff of the Soil Research Center (1983) in Eviati and Sulaeman (2009) (table 4), a characteristic map of C-organic values and a C-organic status map (annex 8) were obtained with very low, low and medium status.

Table 4. Soil Analysis Results Assessment Criteria

Sifat Tanah	C-Organik Soil (%)
Very Low	<1
Low	1 - 2
Keep	2 - 3
Tall	3 - 5
Very High	>5

Table 5. Area of C-organic Distribution Based on Criteria

Criterion	Area (ha)	Percentage (%)	Sample Number	Region Village
Very Low	250,90	18,42	17, 18, 23, 24	Liangjulang, Heuleut, Cipaku
Low	512,38	37,63	1, 2, 5, 9,12,13,15, 16, 19, 20, 21, 22, 25	Pagandon, Karang Sambung, Babakan Anyar, Laiangjulang, Heuleut, Cipaku
Medium	598,48	43,95	3, 4, 6, 7, 8, 10, 11, 14	Pagandon, Karang Sambung, Babakan Anyar, Kadipaten
Total	**1.361,76**	**100**		

Based on the map of the distribution of soil C-organic status (annex 8), in rice fields of Kadipaten District, medium nutrient status is more dominant or has a large area compared to low and very low nutrient status,

meaning that the soil at the study location is classified as having moderate availability of C-organic for plants, this is due to the habit of farmers who clean their fields after the harvest period is over.
This is in line with the research of Anicetus and Elisabeth (2021), which states that the decline in C-organic content in the soil can be accelerated by continuous plant cultivation practices, intensive tillage, and restoring plant residues/biomass after harvest. C-organic soil is an important component in soil ecosystems and plays a role in carbon storage and plant nutrient balance. A decrease in soil C-organics indicates that land degradation is occurring in rice fields and has an impact on agricultural productivity.
According to Setiawati et al. (2019), the increase in organic matter content is directly proportional to the increase in C-organic. Giving organic matter to rice fields can increase C-organic because weathering that occurs in organic matter will produce humus that can bind nutrients contained in fertilizers so that nutrients are not easily leached and can be absorbed by plants optimally. The application of organic fertilizers as organic matter in the soil provides many benefits in the soil. The results of research by Maru et al. (2020), the application of organic fertilizer to irrigated rice fields and rainfed rice fields can increase rice crop productivity by 50%.

2. Ratio C/N Soil

Organic matter cannot be used directly by plants but it takes a process to break it down into nutrients, this is because the C/N ratio in organic matter is not necessarily in accordance with soil C/N which ranges from 10-12 (Setyorini et al., 2017). The C/N ratio is the ratio between carbon (C) and nitrogen (N). The C/N ratio is The most important factor in the process of overhauling organic matter. This causes the composting process to depend on the activity of microorganisms, which in the process require carbon (C) as an energy source and cell-forming microorganisms, as well as nitrogen (N) to form cells (Agroinnovation, 2011).
The principle of organic matter overhaul is to reduce the C/N ratio of organic matter to equal to soil C/N (<20), this is done so that the material can be used by plants. The process of remodeling organic matter requires microbial and mesophounal biological activities, this process can occur in aerobic (O2) or anaerobic (without O2) conditions. The higher the C/N ratio of organic matter, the longer the overhauling process. Fresh organic matter that has not undergone a remodeling process and has a C/N value of > 25 is introduced directly into the soil, the decomposition process still occurs, but the weakness will cause the availability of nutrients in the soil to decrease.
This is because microbial decomposers use the decomposition activity of remodeling organic matter. As a result, there is nutrient competition between plants and microbial decomposers in nutrient uptake (Setyoini et al., 2017). In addition, this process produces energy that increases soil temperature. As a result, plant growth can be hampered and even potentially die. Therefore, if you want to provide organic matter into the soil, it is better to do an overhaul process first so that there is no competition for nutrients in the soil between plants and microbial decomposers.
If the material has become compost (humus and other nutrients have formed), the organic matter is beneficial for soil fertility and health and can be used by plants in their growth. As supporting data for the study, the average C/N ratio of the research sample soil was 8.89 (appendix 10). The ratio is not close to the soil ratio (10-12) is under this provision, so it can be concluded that the organic matter at the study site has not been able to used to plant. .

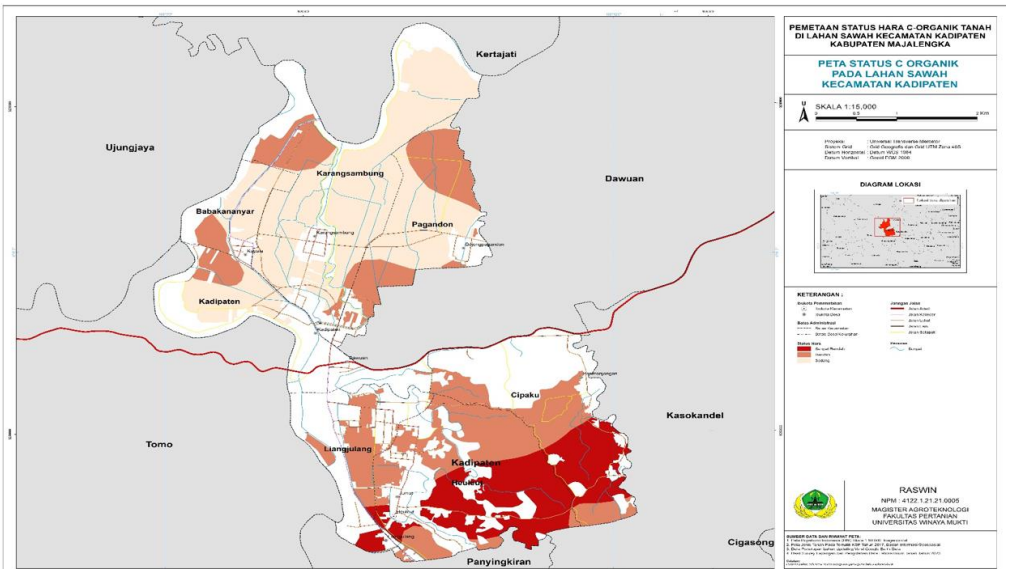

Figure 1. C-organic Status Map Soil of the study area

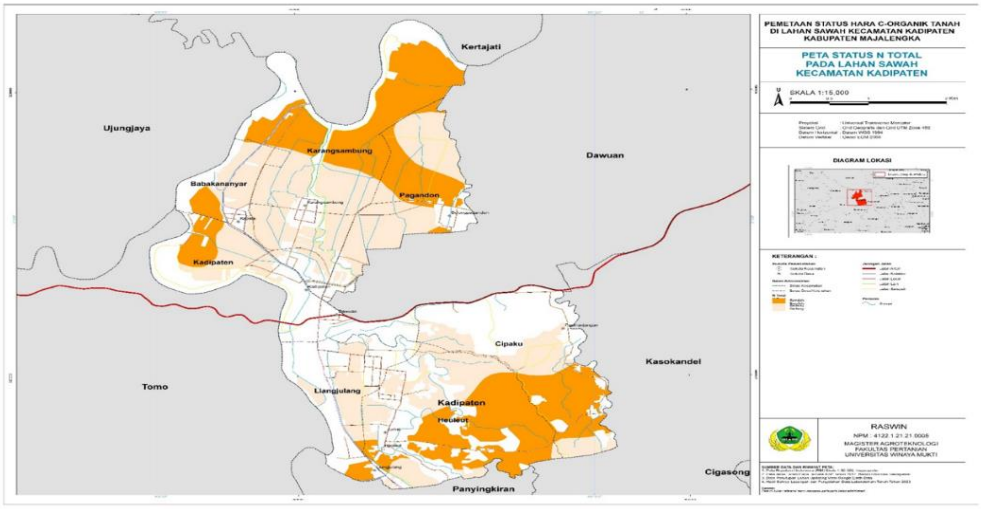

Figure 2. Map of N-total Status in Soil of the study area

CONCLUSION AND ADVICE

Conclusion

Based on the results of experiments and discussions, several conclusions can be drawn as follows:

1. The area of rice fields in the District of the Duchy, which occupies seven delineated villages, is 1,361.76 ha. Where the area of rice fields in the District of the Duchy is irrigated rice fields covering an area of 917.39 ha and rainfed rice fields covering an area of 444.36 ha, with three criteria for the content of C-organic status, namely medium 598.48 ha (43.95%) occupying parts of Pagandon Village, Karang Sambung, Babakan Anyar, and Kadipaten. The area with low C-organic area is 512.38 ha (37.63%), occupying parts of Pagandon, Karang Sambung, Babakab Anyar, Liangjualang, Heuleut, and Cipaku villages. Then, for very low C-organic criteria covering an area of 250.90 ha (18.42%) occupying part of Liangjulang, Heuleut, and Cipaku Villages.
2. The C/N ratio of organic matter in rice fields in Kadipaten District has not approached the soil ratio (10-12) below this provision, which is an average of 8.89, so it can be concluded that organic matter in the research location cannot be used by plants, it must be processed first.

Suggestions and Acknowledgments

Based on the conclusions above, paddy fields must be processed first before planting; the addition of organic matter must also be added to the planting process for maximum results**.**

On this occasion, the author expressed his gratitude to all parties who have helped, especially to the Forestry Vocational School of the Duchy of Majalengka Regency, for providing much support in implementing this research.

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DOI: https://doi.org/10.15379/ijmst.v10i4.3548